CALIFORNIA
ENERGY
COMMISSION

# PRELIMINARY EVALUATION OF PILOT PERFORMANCE-BASED INCENTIVE PROGRAM

STAFF REPORT

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Arnold Schwarzenegger, *Governor*

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# ABSTRACT

This report describes the history of the California Energy Commission's Pilot Performance-Based Incentive Program, including how the program has evolved since its start in January 2005. The Pilot Performance-Based Incentive program, developed under the Emerging Renewables Program, provides performance-based incentives to electricity customers of Pacific Gas and Electric, San Diego Gas & Electric, Southern California Edison, and Bear Valley Electric Service, who purchase and install eligible photovoltaic systems at their site and who elect to participate in the Pilot Performance-Based Incentive program. The incentive is calculated based on the generation output (performance) of the photovoltaic systems as opposed to traditional capacity-based incentive programs such as the California Public Utilities Commission's Self-Generation Incentive Program and the Emerging Renewables Program. The Performance-Based Incentive Program incentive is paid over a three-year period while both the Emerging Renewables Program and Self-Generation Incentive Program incentives are paid upfront. This report evaluates the Pilot Performance-Based Incentive program after one year through data gathered from program applications and from surveys conducted in June and July 2006. As a basis for comparison, staff also surveyed customers of the Self-Generation Incentive Program. The surveys reveal that tracking systems, which enhance system performance, are used relatively more frequently by Performance-Based Incentive respondents. Financing does not seem to be a challenge for Performance-Based Incentive respondents, despite having to pay the full upfront capital cost of the system. However, state incentives are still very important and are the primary motivation why respondents installed photovoltaic systems. Finally, both Performance-Based Incentive and Self-Generation Incentive Program respondents are, in general, very satisfied with their system performance.

# KEYWORDS

Solar, photovoltaic, PV systems, performance-based, electric generation-based, capacity-based, incentive, rebate, PV installation, renewable technology system, renewable program, solar program, solar energy, PV generation, program evaluation, capacity factor, Emerging Renewables Program, renewable energy

# EXECUTIVE SUMMARY

This report summarizes an evaluation conducted by the California Energy Commission (Energy Commission) of its Pilot Performance-Based Incentive Program. The Performance-Based Incentive program was developed as part of the Emerging Renewables Program and is specially funded for qualifying applicants who install photovoltaic systems to receive incentives based on actual electricity generated by photovoltaic systems. As described in the *Emerging Renewables Program Guidebook*, Energy Commission staff were directed to evaluate the Performance-Based Incentive program after one year, to determine if the program objectives had been met. To fulfill this requirement, a survey tool was developed by the Energy Commission and sent to Performance-Based Incentive applicants in June and July of 2006 to evaluate the design and criteria of the Performance-Based Incentive program and to monitor program participation at this early stage.

Since 1998, the Energy Commission has promoted the development of renewable, distributed generation technologies through financial incentives. The primary incentive mechanism used for photovoltaic systems has been capacity-based rebates, which help reduce photovoltaic's high upfront capital costs. Lower upfront consumer costs should speed adoption, thereby leading to increased production volumes that should, over time, help drive system costs lower. As the Emerging Renewables Program developed, it became apparent through verifications and investigations that some photovoltaic systems installed under the program were not achieving expected performance (that is, there was a significant variation between potential and actual output among some of the photovoltaic systems). While upfront rebates clearly encouraged program participation, they did not necessarily promote optimal system design and performance, potentially leading in some cases to subpar system performance and reliability. Underperforming systems are inconsistent with a fundamental Energy Commission goal: to make sure that program funds are used effectively and offer maximum ratepayer benefits. Therefore, the concept of a performance-based incentive was pursued to help ensure that state funding would encourage system performance and reliability and maximize ratepayer benefits.

The Performance-Based Incentive program's incentive payment is $0.50 per kilowatt-hour (kWh) for electricity generated by an eligible PV system and is paid quarterly over three years. Funding is available to all customer classes and is capped at $400,000 per site, but there is no limitation on the size (generation capacity) of a system. The reservation period for system installation is 12 months. A revenue-grade meter is required for all participating systems to measure system generation in kWh. System performance data in kWh may be collected either by the applicant's electric utility or a Web-based monitoring system administered by a third party. The data must be reported to the Energy Commission along with the customer's payment claim to receive the incentive.

Initially, the Energy Commission's Pilot Performance-Based Incentive program ran in parallel with the Energy Commission and the California Public Utilities Commission's capacity-based incentive programs. More recently, under the California Solar Initiative, all systems over 100 kW in size and funded by the California Public Utilities Commission will be paid based on system performance. Smaller systems will continue to receive an upfront incentive, but the funding will now be based on expected system performance. In January 2007, the solar components of the Emerging Renewables Program and the California Public Utilities Commission's Self-Generation Incentive Program were moved to California Solar Initiative. This effectively closed the Pilot Performance-Based Incentive program to potential new applicants.

### Pilot PBI Program Survey Results Summary

In June and July 2006, Performance-Based Incentive applicants were sent surveys to determine: 1) which customer classes chose performance-based incentive, 2) why Performance-Based Incentive participants chose the performance-based incentive over a capacity-based incentive, 3) the participants' experience with the Performance-Based Incentive, and 4) problems encountered with the program administration and resolutions. A total of 17 of the 41 Performance-Based Incentive applicants responded to the Performance-Based Incentive survey. Note that most of the Performance-Based Incentive applicants during the survey either just submitted an application or were in the process of purchasing and installing their systems, hence, a low survey response. Among 15 respondents, the photovoltaic system size ranged from 5 to 200 kW (AC), averaging 49 kW. Thirty-three percent of the Performance-Based Incentive respondents use tracking systems (this is a physical tracking mechanism that follows the sun to enhance system performance, not a software monitoring system). This compares to just 13 percent of the Self-Generation Incentive Program survey respondents that report using a tracking system. The majority of Performance-Based Incentive respondents are commercial applications. Most respondents used cash to pay for their photovoltaic systems, even though equipment cost was cited as the most challenging factor. Upfront capital costs and insufficient incentive levels are the two highest risk factors respondents shared regarding the Performance-Based Incentive Program. The immediate approval of Performance-Based Incentive reservation amount is very important to more than half of the respondents, and the availability of state incentives is the top reason respondents installed photovoltaic systems.

Other points learned from the Performance-Based Incentive surveys include:

- Sixty-five percent of respondents were located in Pacific Gas and Electric's service territory.
- The majority of the systems face due south.
- All respondents plan to clean their panels regularly, averaging more than four times per year.
- According to seven Performance-Based Incentive respondents, the estimated annual photovoltaic output averages 1,680 kWh per kW (AC), while the minimum annual output needed to make their PV project economically viable averages 1,361 kWh per kW.
- Forty-two percent chose to participate in the Performance-Based Incentive program because of program design (for example, incentive based on production), while financial reasons and tax purposes/advantages each received 33 percent response rate.
- Forty percent of respondents said the current 12-month reservation period is not long enough (mainly due to shortage of panels), and most prefer a 24-month period.
- Sixty-seven percent said three years is the maximum number of years they would be willing to accept Performance-Based Incentive payments, and all respondents were satisfied with a quarterly payment schedule.
- A third of the respondents thought that the added cost of reporting system performance might prevent customers from participating.
- Financing does not seem to be a challenge for Performance-Based Incentive respondents, despite having to pay the full upfront capital cost of the system.
- Only seven respondents indicated that their systems have been installed and are operational (although only five have requested payments).
- Overall, the respondents' experience with the Performance-Based Incentive Program and the Energy Commission are satisfactory.

Because of the relatively few completed projects, this report will cover only Performance-Based Incentive Program experience and process evaluation. It is anticipated that a follow-up report will be produced and published in 2008 to include photovoltaic generation data from Pilot Performance-Based Incentive program participants.

The Energy Commission also surveyed participants in the Self-Generation Incentive Program through the assistance of the utility program administrators. A total of 43 of the 180 Self-Generation Incentive Program participants responded to the Self-Generation Incentive Program survey. This parallel survey was conducted to evaluate any other differences between the Pilot Performance-Based Incentive program and the Self-Generation Incentive Program (which offers capacity-based, rather than performance-based, incentives). Although the surveys are similar, they are not identical.

- Only 13 percent of Self-Generation Incentive Program respondents chose tracking systems, compared to 33 percent of PBI respondents.
- Self-Generation Incentive Program respondents are relatively more knowledgeable of their expected system annual output, although many of the Performance-Based Incentive respondents had not yet installed their systems (or had a full year of operational experience).
- Both surveys revealed that financing is not a major problem to respondents but indicated the need for incentive programs.

It is important to note that the small sample size among both groups of respondents, and in particular the Performance-Based Incentive respondents, coupled with a lack of complete standardization among the surveys sent to each group, limits the authors' ability to draw any firm conclusions.

# Chapter 1: Introduction

This report summarizes an evaluation conducted by the California Energy Commission (Energy Commission) of its Pilot Performance-Based Incentive (PBI) Program. The Pilot PBI program was developed as part of the Emerging Renewables Program (ERP) and is funded for qualifying applicants who elect to participate by installing photovoltaic (PV) systems to receive incentives based on the actual electricity generated by PV systems.

The PBI program began in January 2005, with $10 million allocated to performance-based incentives. Eligibility requirements are described in the *ERP Guidebook*.[1] The PBI program had operated in parallel with capacity-based incentives offered by the Energy Commission (ERP rebates) and by the California Public Utilities Commission (CPUC) under the Self-Generation Incentive Program (SGIP).

This preliminary staff evaluation includes a summary of Pilot PBI program activity to date, and results and analyses of a survey to PBI and SGIP participants conducted in June and July 2006. Since only a few of the PBI participants' PV systems have been installed to date, a follow up program report is planned for 2008 that will include PV generation data component.

## History of the Energy Commission's PBI Program and its Development

Since 1998, the Energy Commission's ERP has attempted to expand the development of specific renewable generation technologies through financial incentives. The principal incentive mechanism has consisted of capacity-based rebates, which are intended to reduce the upfront capital costs of otherwise high-cost technologies. The goal has been to help increase production volumes, thereby, over time, lowering total installed costs. Four customer-sited renewable generation technologies have been eligible for rebates under the ERP: PV systems, small wind (50 kW or smaller), solar thermal electric, and fuel cells using renewable fuels. Only PV technology is eligible for the Pilot PBI program.

Early on in the ERP, it became apparent that a significant number of PV systems were falling short of generation and reliability expectations.[2] Through periodic inspections to verify that systems were installed in accordance with ERP requirements, investigators found a significant variation between potential and actual energy output among some of the PV systems. Although upfront, capacity-based rebates encouraged greater program participation, issues such as lower-than-expected energy output and reduced reliability/dependability from some PV systems made it apparent that system design and performance may not be adequately controlled by upfront rebates.

Other incentive approaches have been used elsewhere and were considered for California. For example, Germany initiated a solar program in 2000 wherein the incentive rate was based on a system's output (that is, performance). In 2005, the state of Washington also began offering an incentive structure for solar and wind systems based on a system's actual output. A performance-based incentive would encourage proper design, installation, and maintenance of PV systems to maximize payback. This performance-based approach offers potential solutions to the shortcomings of capacity-based incentives (CBI) described above. A performance-based

[1] The PBI Program requirements are in the "Special Funding" chapter of the *ERP Guidebook*, from Fourth to Seventh Editions.
[2] *Consultant Report, Emerging Renewables Program Systems Verification Report 2004-2005*, December 2005.

approach can also help ensure that incentive payments are made only to systems that are not relocated or removed during the time over which the PBI payments are made.

In 2004, signaling its intent to investigate performance-based incentive mechanisms, the Energy Commission directed its technical support contractor to research performance-based incentives. Public Resources Code Section 25744 (Senate Bill 183, Sher, Chapter 666, Statutes of 2003) authorized the Energy Commission to develop a program that provides incentives based on the performance of eligible distributed renewable technology systems. By this authority, the Energy Commission allocated $10 million dollars for a Pilot PBI Program. The PBI program would run with the existing ERP and the SGIP, allowing customers to choose between the CBI programs and the Pilot PBI program.

On September 27, 2004, Energy Commission staff conducted a workshop and presented the Staff Draft Proposal for a Pilot PBI program to solicit input from interested parties. Workshop attendees recommended approaches for implementation of the Pilot PBI program. Written comments from several parties were received and considered.

On December 1, 2004, the Energy Commission's Renewables Committee (Committee) conducted a public workshop to seek comments on a proposed Pilot PBI program and other changes to the *Emerging Renewables Program Guidebook*. The Committee considered oral and written comments received during the workshop before the final draft. On January 19, 2005, the Energy Commission adopted the report *Decisions on Pilot PBI Program*, which outlines the decisions and rationale for the design of the proposed Pilot PBI program. The *ERP Guidebook, Fourth Edition,* which included detailed information on PBI eligibility requirements and forms for applicants seeking rebate reservations and payments under this program, was also adopted at this time. The Committee also directed that an evaluation of the PBI Program be conducted one year following the start of the program.

The January 2005 *Decisions on Pilot PBI Program* report outlined the following questions to be answered when evaluating the Pilot PBI program:

- What customer classes participated and why did they choose a PBI over a standard upfront rebate?
- How does the actual performance of PV systems participating in the Pilot PBI program compare with PV systems installed with an upfront rebate? Did the Pilot PBI program attract high-quality systems that are ideally installed and optimally maintained?
- Did the Pilot PBI program extend ratepayer funds and deliver more benefits for California ratepayers by supporting more PV generation than standard rebates?

This report seeks to address the first of the three bullets above. Since only a few participating systems have so far been installed and begun operating, it is premature to address the last two bullets. However, the survey was able to reveal some information on whether PV systems were properly installed and maintained.

Information presented in this report may be useful in future modifications of a larger-scale PBI program adopted by the CPUC in a CPUC decision in August 2006. The California Solar Initiative (CSI) is a $3.3 billion 10-year program that started in January 2007. The solar components of ERP and SGIP were moved to CSI, and this effectively closed to potential new applicants the Pilot PBI program after December 31, 2006. Governor Schwarzenegger signed Senate Bill 1 (Murray, Chapter 132, Statutes of 2006), which required additional specific provisions in implementing the CSI program. The CSI program is designed to promote the use of PV systems with a goal of installing 3,000 megawatts (MW) of new solar capacity by 2017. The New Solar Homes Partnership, a $400 million program under the CSI, is managed by the

Energy Commission to encourage the installation of solar photovoltaic systems in new home construction.

# Program Objectives and Design

The primary goal of the Pilot PBI program was to determine if an incentive payment contingent on a system's performance could be a more effective incentive mechanism than the existing capacity-based incentives that provide upfront rebates. This Pilot PBI program would verify whether electricity production from PV systems can be maximized by offering incentives based on actual electricity output. It was expected that the Pilot PBI program would attract participants with systems and installations that have the highest performance, such as those with superior design, orientation, and in locations with high solar insolation. Additionally, it was expected that the program would encourage regular system maintenance. Finally, it was anticipated that the program would provide useful information as to whether Web-based or utility-based monitoring systems provide realistic monitoring mechanisms.

The following is a summary of the adopted Pilot PBI program:

- A single incentive level of $0.50 per kilowatt-hour (kWh) for all participants is paid quarterly for the first three successive years of uninterrupted performance.
- All customer classes are eligible, but participants must meet ERP eligibility requirements.
- Funding is capped at $400,000 for any single installation, with a $1,000,000 cap for any corporate or government parent; there is no minimum or maximum system size limit.
- The reservation period for system installation is 12 months.
- A revenue-grade meter is required for all participating systems.
- The participant must coordinate with a third-party provider to report performance data using a Web-based reporting system or a utility reading and reporting system.
- Participants must cooperate with Energy Commission-sponsored efforts to evaluate the Pilot PBI program.
- Encumbered funding per project is limited to expected performance based on a 25 percent capacity factor.

The Pilot PBI program was designed to operate concurrently with the traditional capacity-based rebate offered through the ERP and SGIP, allowing customers to choose between the two incentive types offered by the Energy Commission. The incentives and reservation period under the Pilot PBI program cannot be combined with other funding under the ERP, the SGIP, or the Rebuild a Greener San Diego program approved by the CPUC (or any other rebate program funded with electric utility ratepayer funds). The Pilot PBI program does not include a loan or financing element.

## *Program Incentive Level and Limit*

Based on workshop discussions and public comment, a single incentive level for all customer classes was considered the simplest approach to evaluate the program and compare customer participation in the Pilot performance-based program relative to the existing CBI programs. Initially, staff had proposed an incentive level of $0.25 per kWh over a five-year period. Some stakeholders commented that this incentive was too low and argued that for a performance incentive to be equal to $2.80 per watt (rebate level of ERP from January 2005 to June 2006), the performance payment should be $0.35 per kWh.[3] Depending on economic factors affecting the

[3] Comments made at the September 27, 2004, staff workshop and submitted to Docket No. 02-REN-1038 from Cal SEIA and Bonneville Environmental Foundation.

customer, a residential customer's performance-based incentive ranges from $0.54 to $0.87 per kWh while a commercial customer's performance-based incentive ranges from $0.32 to $0.73 per kWh.[4] Comments made at the December 1, 2004, workshop by some stakeholders suggested that the incentive level of $0.35 per kWh over three years was inadequate.[5] As a result, the incentive level was set at $0.50 per kWh.

The Energy Commission has the authority to adjust the incentive payment to a level it determines is appropriate for a successful Pilot PBI program participation.

## Program Eligibility

The Pilot PBI program is open only to participants that install PV systems that meet the eligibility requirements specified in the *ERP Guidebook*.

Also, participants must be electric customers of the following four eligible utility companies: Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), and Bear Valley Electric (BVE).

Initially, it was expected that the commercial sector would benefit most under this program because it was believed that the advantages of potential tax credits and accelerated depreciation were superior under PBI than a CBI program. Later analysis suggests that the tax impacts of PBI and CBI programs may be equivalent, and therefore a PBI is not necessarily superior on this basis.[6] The Energy Commission did not anticipate participation from the residential sector since upfront rebates were being offered and provide quicker payments. In some measure, it was expected that smaller residential customers would not have the same ability to evaluate and accept a more complex program as would larger commercial customers.

## Reservation and Payment

Since the Pilot PBI program focuses on generation, the Energy Commission decided to place a cap on funds rather than system capacity. A funding limit of $400,000 per system allows the applicant more flexibility in system size. The amount of funds to be reserved was determined by multiplying the following four components: the system rated capacity, expected maximum generation, incentive level, and payment duration.

Initially, the maximum funding for systems was based on a 25 percent capacity factor. In July 2005, the Energy Commission adopted the *ERP Guidebook, Fifth Edition*, which changed the capacity factor to 30 percent based on stakeholder input that PV systems with tracking systems can have a capacity factor above 25 percent. When interest in the program later increased, staff found that the majority of new participants did not use tracking systems (though the survey revealed that more PBI respondents use tracking systems compared to SGIP respondents), and therefore an over-encumbrance of funds was occurring relative to expected electricity generation. The Energy Commission adopted the *ERP Guidebook, Sixth Edition* in January 2006, and the capacity factor was again modified to 20 percent for fixed systems and 30 percent for tracking systems relative to the PV USA Test Conditions (PTC) rating of the PV array. PTC

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[4] *Decisions on Pilot Performance-Based Incentive Program* CEC-300-2005-002-CMF, published January 2005, analysis for both a residential and commercial customer purchasing the system with cash or a loan, page 7.

[5] Ibid. endnote 19.

[6] PowerPoint presentation to CPUC on Federal Tax Incentives for PV - Potential Implications for Program Design by Ryan Wiser and Mark Bolinger (Lawrence Berkeley National Laboratory) on March 16, 2006, http://www.cpuc.ca.gov/static/energy/solar/ryan_wiser_presentation_on_tax_incentives_at_pbi_workshop__march_16__2005.ppt.

ratings are used in the ERP to calculate rebate amounts and were established to provide a rating on modules that more closely represents real world conditions, as compared to the standard test conditions provided by PV module manufacturers. This change was made to address the problem of "over-encumbering" funds for conventional PV systems, while maintaining a sufficiently high capacity factor for projects with tracking systems. The following formula is used to calculate reserved funds:

**Reserved Funds = (PV Array kW)$_{PTC}$ x (8760 hrs/year x 0.20[†] kWh/kW) x $0.50/kWh x 3 years**

[†] 0.30 for tracking systems

The reservation period under the Pilot PBI has two phases – a 12-month preliminary reservation period, during which the system is purchased and installed, and a three-year final reservation period, during which the applicant submits quarterly invoices (containing system generation data) for payment. The 12-month preliminary reservation period (versus nine months for most ERP participants) was established to allow adequate time for larger systems (that is, over 30 kW) to be installed and to allow comparison with the SGIP, which also provides a 12-month reservation period.

Payments are paid over a three-year period for 12 uninterrupted and consecutive quarters. Although other options were examined on payment period and frequency of payments, the Energy Commission considered all comments from stakeholders and other existing similar programs. Since this is a Pilot PBI program, the Energy Commission felt a three-year payment period would be appropriate. Payments are made based on actual energy generated by month and reported to the Energy Commission quarterly. It is important to note that participants who experience generation interruptions (for example, because of maintenance or system failure) during the three-year final reservation period are not allowed to "make up" time after the three-year period is over.

A new Payment Request Form (CEC-1038 R10) was created for PBI program participants to submit along with other payment documentation to initiate the payment process after the PV system becomes operational. The energy produced by the system is verified either through the participant's utility or a third-party administrator before payment is approved.

### *Performance Verification and Data Reporting*

PBI applicants are required to install a revenue-grade meter that measures the system's electricity production (kWh). The performance meters required under the ERP cannot be used as a substitute since they do not meet the measurement standards required for revenue-grade meters. Applicants are responsible for the costs associated with the purchase and installation of meters.

Program participants are also responsible to collect performance data and report PV performance to the Energy Commission. Participants may report it in one of two ways: through a Web-based monitoring system administered by a third party or through the participant's electric utility company (although only two utilities - PG&E and SDG&E - have a procedure in place for PBI reporting). A majority of the PBI participants are using third-party administrators, and only two participants use their electric utility to monitor their PV system performance.

## Program Evaluation

As a condition of receiving incentive payments under the Pilot PBI program, applicants must agree to participate in an evaluation process. In June and July 2006, the Energy Commission

conducted a mail survey to all PBI applicants to determine if the objectives outlined for the Pilot PBI program had been met.

This evaluation was specifically developed to determine: 1) which customer classes chose PBI, 2) why PBI participants chose the PBI over a CBI, 3) the participants' experience with the PBI, and 4) problems encountered with the program administration and resolutions. At this time, it is premature to discuss the actual performance of the systems and whether the program attracted high-quality systems, since few PBI participants were generating electricity at the time of the survey.

## Potential Benefits of a PBI Program

Certainly, the payments of PBI are a benefit to the consumer in addition to the benefit they receive from the PV system itself (lower electric bill and less dependent on utility). Assuming an average PV cost of $8,000 per kW before incentive, with the PBI payments, incentives help reduce the final system cost by up to 33 percent.[7] In addition, if the actual performance of the PV system is better than the expected output, the participant can receive higher incentive payments.

Given the fundamentally different approach in providing the incentive, the PBI Program should promote superior PV system design, installation, and maintenance. These factors directly affect performance and ultimately payback. Electricity production can be maximized depending on the location of installation within the state (determining annual solar irradiation, ambient temperatures, and so forth), choice of equipment, quality of installation, and ongoing maintenance. Examples of these factors include use of a tracking device, system orientation and tilt, standoff height, degree of shading, and soiling. The program also encourages ongoing attention to maintenance, including periodic cleaning of modules, to attain maximum energy production. Participants are encouraged to monitor their systems so they know when to call their installer for service if a problem occurs.

Another benefit is that the PBI program's three-year payment duration discourages customers from removing or relocating the PV system, at least during the PBI payment period, unlike a CBI program that does not typically verify a system once the upfront payment is made.

## Potential Risks and Disadvantages of a PBI Program

A number of disadvantages, as well as added risks, exist with PBI programs. A known risk of the PBI Program is the potential for a lower level of participation because of the longer payment term. Customers may prefer to receive their incentive payment upfront because of the high initial capital cost associated with the purchase and installation of a PV system, and the added performance risk associated with an ongoing PBI. Since electricity from PV installations is often not cost-competitive with that provided from the electric utility grid, customers may resist purchasing a system with a longer term incentive payout. Adopting a shorter PBI payment period may ease these concerns, but increases the potential risk of underpayment should unusual weather conditions or problems with the PV or metering system occur. Overall, PBI programs may need to provide greater incentives than a CBI equivalent to compensate for the customer absorbing performance risk. Similarly, to receive the same level of customer participation, a PBI program may require higher payments given the time value of money. Another risk of managing a PBI program is the need to guard against potential fraud, in this case the possibility of overreported system production. Just like any other program, the risk of

[7] A PV system with a capacity of 1 kW can produce about 1,752 kWh per year, based on a 20 percent capacity factor. 8,760 hours per year x .20 capacity factor = 1,752 kWh per year. 1,752 kWh per year x $0.50 per kWh x 3 years = $2,628 total incentive payment.

some form of fraud will always be present, but through careful management and close collaboration with the metering administrators, this risk could be lessened in PBI programs.

PBI program participants also face the risk of uncertain payments over the life of the payment period. For example, the equipment seller or installer may overestimate the expected performance, resulting in lower payments. Additionally, unforeseen events, such as weather and system component failure, may result in lower generation and payment. In such cases, the consumer is hurt both by failing to capture the electricity generation benefit (through reduced utility bills) as well as forgone PBI payments.

Finally, early adopters under the PBI program may also be hurt, especially in the early years, where incompetent or unscrupulous retailers/installers put up poorly designed or installed systems. In such cases, the PV system owners may end up with considerably less in total payments than anticipated. Again, electricity production can be affected when a PV system is not regularly maintained by a customer. As a result, a customer would receive a lower incentive payment than expected, which also ties up reserved funds that could be available to other customers.

# Chapter 2: Pilot PBI Program Activity

This chapter discusses the Pilot PBI Program activities since its inception and provides an overview of the problems encountered to date and how they were resolved as the program evolved.

## Program Launch

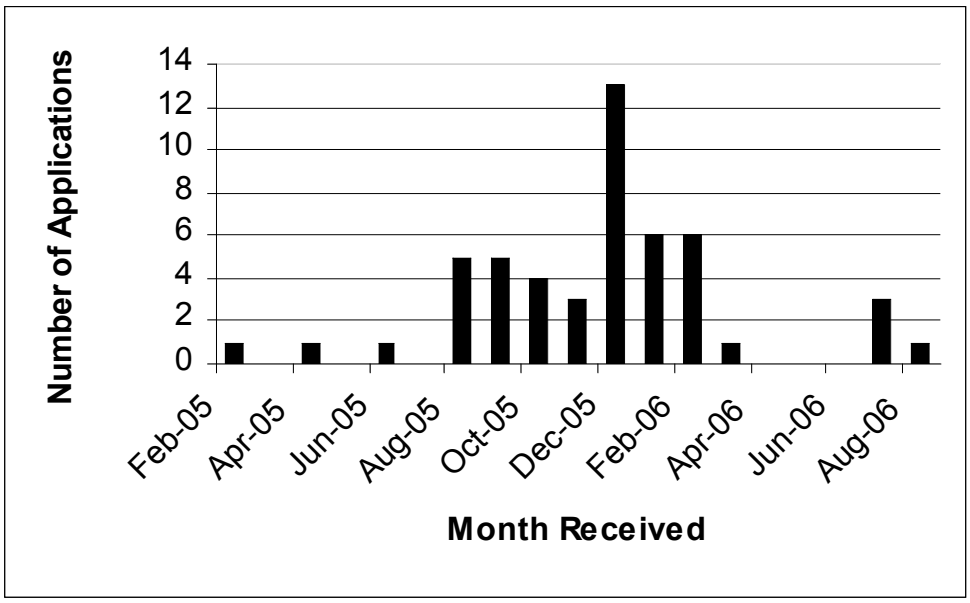
Since the Pilot PBI program began, only modest attempts have been made by the Energy Commission to promote the program and inform potential applicants. During the course of the first six months of the program, the Energy Commission provided program information on its website, in addition to the program information described in the *ERP Guidebook*.

On average, the program received four applications per month; however, applications were not received steadily. During the first seven months of the PBI program, only three applications reflecting 144 kW of system capacity had been received. This amounted to a funding encumbrance of $243,190. However, from August 2005 to March 2006, the application volume increased significantly as shown in Figure 1, with an average of five applications per month for an additional 43 applications reflecting 3,604 kW of system capacity. Staff believes the main reason for the increase in applications can be attributed to increased awareness of the PBI program, as well as oversubscription of the SGIP's PV rebate program, which ran out of funds in 2005.[8]

By the end of March 2006, it appeared that enough applications had been received to encumber all remaining PBI program funds. As news of diminished funding spread through the industry, coupled with the 2006 reopening of the SGIP (where wait-listed 2005 applicants were accepted into the 2006 program at a higher 2005 incentive level than the 2006 incentive level), interest in and applications for the PBI declined markedly. Retailers no longer viewed the program as a viable alternative to the ERP and SGIP. It is possible that interest would have remained robust had the PBI program received a larger amount of program funding.

[8] PG&E and SDG&E ran out of funds for new projects in February 2005, while Southern California Gas Company and SCE ran out of funds in April and October 2005, respectively.

**Figure 1. Number of PBI Applications Received (Monthly)**




## Participation Overview

During 2005, a total of 12 applications were approved, reflecting various system sizes ranging from 5 kW to 140 kW of rated capacity with an average of 46 kW per system. The total amount of funds reserved in 2005 was $2.08 million, averaging $173,252 per system. During 2006, the Pilot PBI program had approved 25 more applications with system size ranging from 3 kW to 170 kW, averaging 86 kW per system. Also, the program reserved a total funding of $6.06 million in 2006, averaging $242,203 per system. Of the 37 approved applications over the entire PBI program period, only 10 had installed their systems and submitted payment claims as of November 2006. By December 2006, there are still two applications pending approval. Eleven applications had been rejected for various reasons, mainly SGIP participation. Some of these applicants canceled their PBI applications when they received approval under the SGIP, which had a higher a rebate level. The total funds encumbered peaked in September 2006 at $9.2 million and as of November 2006 there was approximately $8.1 million encumbered for the 37 approved systems. After December 31, 2006, the PBI program effectively closed to new applications. Beginning January 2007, the PV portion of the ERP was moved to CSI (overseen by the CPUC) with the Energy Commission overseeing the New Solar Homes Partnership (a component of CSI that provides incentives for new homes construction).

The following tables list the PBI applications approved during 2005 and 2006. Also shown is the status of each application. Within the "Status" column, payment request indicates that the system has been installed and has been operating for at least a full quarter whereas an approved status means that an incentive amount has been reserved for that system.

## Table 1. PBI Applications Approved in 2005

| Utility Company | Size (Watts) | Date Approved | Status | Amount Reserved |
|---|---|---|---|---|
| PG&E | 57,052 | 24-May-05 | Payment Request | $197,967.00 |
| | 5,100 | 13-Oct-05 | Payment Request | $21,386.00 |
| | 15,299 | 13-Oct-05 | Payment Request | $64,158.40 |
| | 57,200 | 07-Nov-05 | Approved | $245,673.30 |
| | 39,974 | 07-Nov-05 | Approved | $167,635.90 |
| | 139,892 | 14-Dec-05 | Approved | $400,000.00 |
| SCE | 7,673 | 02-Aug-05 | Payment Request | $26,128.50 |
| | 31,200 | 16-Dec-05 | Approved | $134,658.70 |
| SDG&E | 74,484 | 10-Aug-05 | Payment Request | $310,704.50 |
| | 16,908 | 09-Nov-05 | Approved | $70,530.30 |
| | 35,463 | 09-Nov-05 | Approved | $147,931.40 |
| | 68,714 | 17-Nov-05 | Payment Request | $292,253.60 |
| **Total** | **548,959** | | | **$2,079,027.60** |

## Table 2. PBI Applications Approved in 2006

| Utility Company | Size (Watts) | Date Approved | Status | Amount Reserved |
|---|---|---|---|---|
| PG&E | 79,415 | 13-Jan-06 | Payment Request | $19,094.50 |
| | 50,996 | 13-Mar-06 | Approved | $141,817.00 |
| | 113,324 | 13-Mar-06 | Approved | $400,000.00 |
| | 5,125 | 15-Mar-06 | Approved | $22,201.30 |
| | 21,532 | 15-Mar-06 | Payment Request | $59,878.50 |
| | 169,987 | 17-Apr-06 | Approved | $400,000.00 |
| | 75,000 | 19-Apr-06 | Approved | $309,634.60 |
| | 75,000 | 19-Apr-06 | Approved | $309,634.60 |
| | 21,941 | 02-May-06 | Payment Request | $59,878.45 |
| | 19,832 | 08-May-06 | Approved | $55,151.21 |
| | 132,590 | 02-Jul-06 | Approved | $368,725.00 |
| | 76,494 | 02-Jul-06 | Approved | $212,726.00 |
| | 121,824 | 02-Jul-06 | Approved | $338,786.00 |
| | 150,013 | 02-Jul-06 | Approved | $400,000.00 |
| | 166,729 | 02-Jul-06 | Approved | $400,000.00 |
| | 117,290 | 14-Jul-06 | Approved | $326,180.00 |
| | 150,013 | 17-Jul-06 | Approved | $400,000.00 |
| | 3,072 | 28-Aug-06 | Approved | $8,544.15 |
| SCE | 48,422 | 13-Mar-06 | Approved | $201,988.00 |
| | 121,912 | 15-Mar-06 | Approved | $400,000.00 |
| | 150,678 | 15-Mar-06 | Approved | $400,000.00 |
| | 43,234 | 15-Mar-06 | Approved | $180,346.50 |
| | 10,146 | 15-Mar-06 | Payment Request | $42,321.00 |
| | 119,748 | 25-Oct-06 | Approved | $331,260.50 |
| | 96,995 | 03-Nov-06 | Approved | $266,912.80 |
| **Total** | **2,141,312** | | | **$6,055,080.11** |

The table below summarizes the PBI applicants by electric service territory. PG&E customers represent 65 percent of the PBI program participants. This skewed proportion is consistent with past verification and analysis of the ERP.

## Table 3. Approved PBI Applicants by Electric Service Territory

| **Utility Provider** | | | | |
|---|---|---|---|---|
| PG&E | SCE | SDG&E | BVE | **Total** |
| 24 | 9 | 4 | 0 | 37 |

A comparison between PBI Program and combined ERP & SGIP applications in 2005 and 2006 is shown below. These approved applications only include projects that are either completed or still active. Note that the minimum eligible system size for the SGIP is 30 kW.

**Table 4. Comparison Between PBI Program and Combined ERP & SGIP Approved Applications (10 kW or larger PV systems)**

| Program | 2005 | | 2006 | |
|---|---|---|---|---|
| | Capacity (kW) | # of Applications | Capacity (kW) | # of Applications |
| PBI | 536 | 10 | 2,133 | 23 |
| ERP & SGIP | 23,751 | 438 | 76,065 | 1,062 |

In 2005 and 2006, approximately 2 percent of the total ERP/SGIP applications applied to the PBI (with systems 10 kW and larger). Clearly, PBI demand is very small relative to demand for ERP/SGIP, suggesting that the pilot PBI program as designed may have reduced demand if it replaced ERP/SGIP. This supports concern over disadvantages of PBI and suggesting that better attention is needed in establishing appropriate incentive levels under a PBI.

# Problems Encountered and Resolutions

Just like any new program, it took time for consumers and retailers to learn about the Pilot PBI Program. Several factors may have delayed the diffusion of program information and participation.

Due to the program being relatively unknown, its complexity, and the fact that incentive payments are paid over a three-year period, it is not surprising that program participation started off slowly. Since most consumers and retailers have been more familiar with the ERP or the SGIP (that is, the CBI programs), participation in those programs has remained high. Importantly, consumers are accustomed to receiving rebates upfront. Given the high capital cost of purchasing and installing a PV system, generally between $8 and $9 per watt before incentives, the incentive payout was apparently too low to attract many away from the CBI programs.

Since PBI payments are spread out over time, determining the expected output of the system is critical in calculating the expected rebate. For the Energy Commission, the appropriate amount of funds to reserve is calculated by using an assumed capacity factor, as previously discussed in Chapter I. Capacity factor is defined as the ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

A study conducted by Itron, Inc., in May 2006 found that the monthly average capacity factor for PV systems under the SGIP in 2003 and 2004 was 17 percent and 16 percent, respectively. A report prepared by KEMA, Inc., in December 2005 for the Energy Commission found that the monthly average capacity factor among ERP participants was 18 percent in 2004 and 2005. Both reports validated the Energy Commission's rationale for dropping the capacity factor used to reserve PBI payments from 25 to 20 percent. It was eventually realized that in most cases the higher encumbrance would not be realistic for most projects and would unnecessarily tie up funding that would ultimately not be used. The higher (25 percent) capacity factor also restricted the Energy Commission from accepting more PBI applications because of the $10 million funding cap.

From a purchaser's perspective, a discount rate may be used to determine the present value of future payments. However, given the relatively short three-year duration of PBI payments, the assumed discount rate is perhaps less important than the concern over performance risk, or the possibility of system failure or underperformance. Factoring risk into the decision-making

process is critical because if a system is offline for any amount of time, the incentive will be less than anticipated, reducing the system's cost effectiveness.

Many program participants questioned how the PBI incentive compares to that of the CBI. Energy Commission staff has estimated that, in general, a well-designed system with above-average production should meet or exceed the $2.80/watt rebate offered by the ERP (during 2005 and part of 2006), while an average system would come in below $2.80/watt. If the CBI was $2.80/watt, a system would need to have a capacity factor of 21 percent to produce enough electricity to receive an equivalent incentive, without discounting. At $3.00/watt, the level many SGIP participants received, a system would need to have nearly a 23 percent capacity factor to equal the PBI incentive. In short, analysis supports that there were monetary advantages to participating in the ERP or SGIP compared to the Pilot PBI program, except perhaps among very high performing systems.

When the Pilot PBI program started, although the elements were outlined in the *ERP Guidebook*, some of the details were not entirely established and clear. Furthermore, the Energy Commission was not completely prepared to address the eligibility requirements of the data acquisition systems and revenue-grade meters (a device capable of measuring system generation in kWh).

Several process issues with reservation applications occurred causing delays in approval. The most common deficiencies, the Data Acquisition Systems and eligible revenue-grade meters, were not provided in the applications. These deficiencies may have been caused by a lack of information regarding PBI-eligible systems or unclear forms. PBI-eligible equipment was incorporated into the existing ERP equipment lists with notes of PBI compliance; however, no PBI-equipment lists were created. The PBI program instead relied on manufacturers to request product listing and provide documentation.

In the initial stages of the program, equipment was typically identified by potential applicants with staff directing the Energy Commission's technical consultant to investigate and request data for the equipment. This caused delays and uncertainty in the application process. Assembling separate PBI-equipment lists and posting them online may have better facilitated the dissemination of PBI-eligible equipment.

A common problem for PBI applicants was they were not familiar with a revenue-grade meter, which is not the same meter required under ERP. This led to clarification that system performance must be measured using a revenue-grade meter capable of measuring system generation in kWh meeting ANSI[9] C12.1 standard and be accurate to at least plus or minus 2 percent. The performance meter required under ERP does not meet the measurement standards required for revenue-grade meters and cannot be used as a substitute for a revenue-grade meter.

Additionally, the verification reporting system was not fully developed, and it was unclear if customers or the utility/third-party administrator would submit the generation reports directly to the Energy Commission. Currently, the most common method of reporting is a quarterly energy production report provided in spreadsheet format to both the Energy Commission and system owners. However, certain metering administrators report to the system owners with no direct Energy Commission notification. Instead, the system owners send in the report they

[9] The American National Standards Institute (ANSI) coordinates the development and use of voluntary consensus standards in the United States and represents the needs and views of U.S. stakeholders in standardization forums around the globe.

receive from their metering administrator to the Energy Commission. The Energy Commission recommends that either the utility or a third-party administrator be required to submit a copy of the report directly to the Energy Commission for easier verification, reducing the potential for fraud and decreasing time to process payments.

Another problem was that application forms were often not filled out properly; in particular, the equipment section is missing necessary information. Editing the form to make it clearer and including separate fields for PBI-specific equipment could minimize applicant oversight. It is worth noting that the application form did not request participant type (that is, residential, commercial, non-profit, and so forth) information. Therefore, in most cases the customer class was based on analysis of the system size, site address, name of applicant, and so forth. This information is vital in determining what percentage of customer class preferred PBI since this was established only after survey responses were received.

As the program started, one of the concerns expressed by the retailers/installers was that applicants were not comfortable signing purchase or labor contracts if incentives were not yet reserved. Since most systems that would be installed are larger in size and subsequently more costly than typical ERP-funded systems, customers and financiers wanted assurance that their incentives were approved before signing an agreement. This was resolved by taking a more personalized approach with applicants and reducing lead time in reviewing applications.

Two major issues occurred during the payment processing of the program. First, the *ERP Guidebook* dictates that payment cannot start until the system installation is deemed complete. Typically there is a one-to three-month window between final system building inspection signoff and payment approval leading to a considerable amount of system generation that cannot be rewarded during that initial period. Although the generation will be rewarded at the end of the three-year period, customers did not want to miss out on early payments. The second issue that is a distinction between the ERP and PBI is the participants' eagerness for a speedy payment. Since the PBI participants had a larger upfront capital cost than ERP applicants and a longer payout term, they wanted to collect their quarterly incentive payments quickly, even though the *Guidebook* indicated that payments would be made within four to eight weeks of receipt of completed invoices. To reduce this concern, the Energy Commission attempts to expedite all PBI payment requests.

Finally, another concern was the potential for fraud within the Pilot PBI program. There is the possibility that some unscrupulous system owners could attempt to rewire a PV or other generating system to boost output or tamper with the data acquisition equipment or data. To minimize risk, third-party metered outputs are easily analyzed to flag large variations between actual and expected output. This method alerts the Energy Commission staff to potential fraud and facilitates corrective action. In addition, ERP projects are audited randomly and readily monitored by an on-site system verification.

# Chapter 3: Survey Results

To assess the Pilot PBI program, the Energy Commission sent a survey to all 41 PBI applicants in June and July 2006. There were 17 respondents (42 percent) that filled out and returned at least a portion of the survey. At least 10 of these 17 respondents did not yet have an operational system at the time of the survey, and the longest-running system among the respondents had been operating for just one year (since June 2005). Although this lack of sample size and performance history limits the robustness of the survey results, a few interesting anecdotes can be gleaned.

The survey results were compiled and analyzed by both the Energy Commission and its consultant, KEMA, Inc. Simultaneously, the Energy Commission surveyed the SGIP participants through the assistance of its SGIP program administrators.[10] This was accomplished to compare the two programs (PBI Program and SGIP), given some of the differences in program requirements. The SGIP, adopted in March 2001, provides incentives for electric customers of PG&E, SCE, SDG&E, and Southern California Gas Company (SoCalGas) that install renewable and non-renewable self-generation units up to 5 MW in system capacity (note that the incentive is capped at 1 MW).

Since only PV systems are qualified under the PBI Program, the Energy Commission surveyed only SGIP participants that installed PV systems. The SGIP incentive payment requirements for PV project applications include a minimum size of 30 kW and an incentive level that started at $4.50/watt.[11] Given the minimum system size requirement, all SGIP respondents are assumed to be commercial entities. The SGIP complements the existing Energy Commission's ERP by providing rebates based on system capacity, but the ERP is limited to PV systems of up to 30 kW in size. On the other hand, the PBI Program has no system size limit for PV project applications, while it offers incentives based on system performance. For comparison, the table below shows the general requirements of all three programs: PBI, SGIP, and ERP.

[10] The SGIP is administered by the utilities in the service territories of PG&E, SCE, and SoCalGas. In SDG&E's service territory, the program is administered by the San Diego Regional Energy Office.

[11] In 2005, the SGIP rebate level for PV projects was $3.00/watt. In 2006, the SGIP rebate level dropped to $2.80/watt, but incentive payments were reduced to $2.50/watt when statewide level of conditional reservations under this program reached 50 MW.

**Table 5. Program Comparison of PBI, SGIP, and ERP (PV only)**

| Requirements | PBI | SGIP | ERP |
|---|---|---|---|
| Eligible electric customer | All end-use customers | All end-use customers | All end-use customers |
| Eligible utility | PG&E, SCE, SDG&E, BVE | PG&E, SCE, SDG&E, SoCalGas | PG&E, SCE, SDG&E, BVE |
| System size limit | None* | 30 kW to 5 MW** | <30 kW |
| Rebate/Incentive level | $0.50/kWh (2005 & 2006) | $2.50/watt (May to Dec. 2006)<br><br>$2.80/watt (Jan. to Apr. 2006)<br><br>$3.00/watt (2005) | $2.60/watt (Jul. to Dec. 2006)<br><br>$2.80/watt (Jan. 2005 to Jun. 2006) |

*Incentive level is capped at $400,000 per system; with a $1,000,000 cap for any corporate or government parent.
** Maximum incentive payout capped at 1 MW.

# Comparison Between PBI and SGIP Survey Response

This section draws upon results from the PBI and SGIP surveys. The SGIP program administrators sent out a survey to 180 SGIP participants: 49 from PG&E, 50 from SCE, 35 from SDG&E, and 46 from SoCalGas. Forty-three respondents filled out and returned at least a portion of the survey. Of the 43 SGIP respondents, only 23 percent of the SGIP respondents are located in the PG&E service territory (as opposed to 65 percent in the PBI sample), while respondents from SCE and SDG&E had 40 percent and 30 percent of the sample, respectively. Seven percent of the 43 SGIP respondents are from SoCalGas area. In contrast to the PBI survey, it appears that the majority of the SGIP respondents own operational systems. The longest-running system among the SGIP respondents has been operating since 2002.

Since most of the applications in the PBI Program have systems that are larger than 30 kW in size, the SGIP is the most appropriate control group against which to analyze the affects of the PBI Program. We analyzed certain questions that are common to both surveys and/or that enable us to test some of the hypotheses discussed earlier in this report about the potential impacts of a PBI vs. CBI. Specifically, one might think that owners of PV systems receiving an incentive under the PBI might be more likely to do the following: use tracking systems, have a better understanding of the system's expected annual output, seek performance guarantees and maintenance contracts, orient their systems optimally, and limit possible shading. In addition, one might expect PBI recipients to have a more difficult time financing the system, relative to a CBI recipient. Below we put some of these hypotheses to the test, based on survey results.

- **Tracking systems:** 33 percent of PBI respondents reported having a tracking system, compared to only 13 percent of SGIP respondents. This difference is not surprising, since a tracking system will result in higher energy production and hence higher PBI payments. Two PBI respondents and four SGIP respondents did not answer this question.

## Table 6. Comparison of SGIP and PBI Respondents Using Tracking Systems

| | SGIP (n=39) | PBI (n=15) |
|---|---|---|
| Tracking | 5 | 5 |
| Fixed | 34 | 10 |

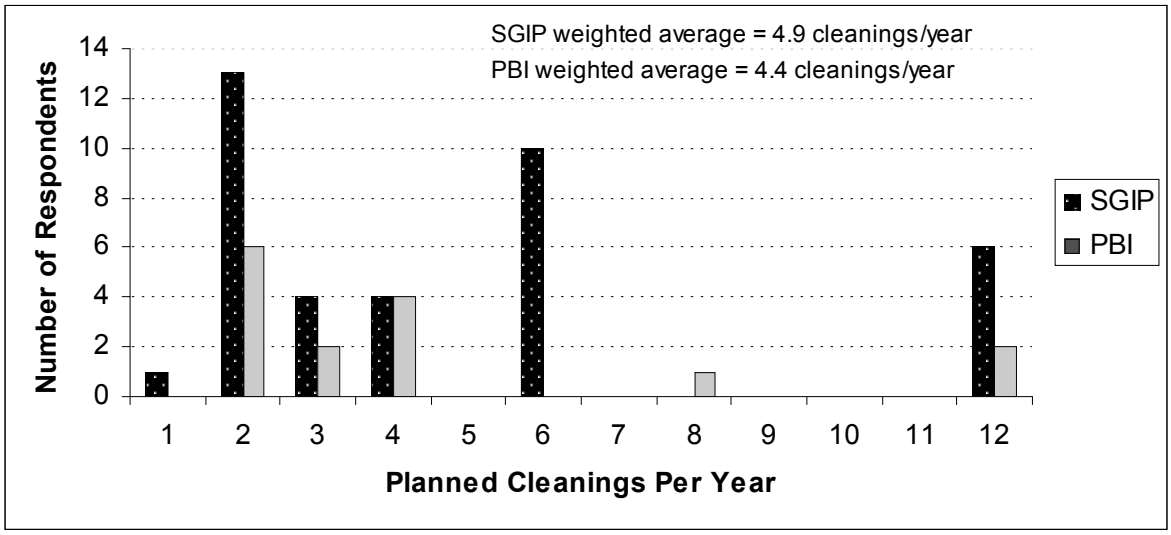
- **Knowledge of expected system output:** Only 9 of the 17 PBI respondents reported their expected annual output. In contrast, 31 of the 43 SGIP respondents seemed to have a working knowledge of expected annual output. This difference, which runs contrary to the notion that PBI recipients will likely be more aware of the amount of energy that their system should be generating, could simply be due to the fact that many of the PBI respondents had not yet installed their systems or had not yet operated their systems for a full year.

- **Maintenance contract:** There does not appear to be much of a difference between the two programs with respect to the presence of maintenance contracts which are not very common among either. Specifically, only 15 percent of PBI respondents reported having a maintenance contract for biannually and quarterly cleaning, compared to 21 percent of SGIP respondents. However, some PBI and SGIP respondents seem to have confused a maintenance contract with a warranty.

- **Financing:** Survey responses do not support the contention that financing will be a problem for PBI recipients, at least among the few customers participating in the Energy Commission's PBI program (the issue may arise to a greater degree if the PBI is used more broadly). Twenty-one percent financed some or all of their systems with loans, compared to 29 percent of SGIP respondents.

- **Panel cleaning:** 100 percent of PBI respondents plan to clean their PV panels, whereas 68 percent of SGIP respondents have cleaned their panels, and an additional 25 percent SGIP respondents plan to clean their panels. The average annual cleaning schedule reported by respondents to both programs is similar (see Figure 2). On average, those SGIP respondents who do plan to clean and have cleaned their panels are targeting 4.9 cleanings per year, compared to 4.4 cleanings per year among PBI respondents (that is, slightly more often than quarterly for both groups).

**Figure 2. PBI and SGIP Respondents' Average Annual Cleaning of PV Panels**



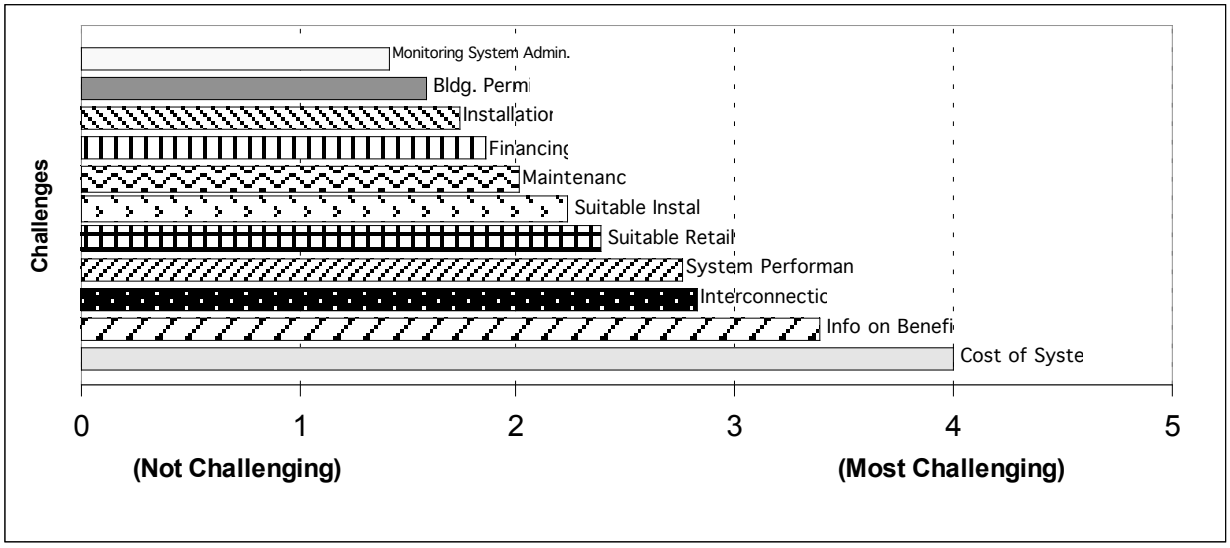

- **System capacity and output:** Among 15 PBI respondents, the PV system's rated capacity varies from 5 kW to 200 kW, averaging 49 kW per system. In comparison, under the SGIP, the system size of 41 respondents ranged from 30 kW to 457 kW, averaging 95 kW. Two PBI respondents and two SGIP respondents did not answer this question.

  According to 7 PBI respondents who answered this question, estimated annual PV output averages 1,680 kWh per kW (AC), while the minimum annual output needed to make their PV project economically viable averages 1,361 kWh per kW. For 23 SGIP respondents who answered this question, the estimated annual output averages 1,844 kWh per kW, and the minimum annual output needed for profitability averages 1,386 kWh per kW.

- **Retailer/Installer Information:** Seventy-one percent of the PBI respondents learned of the PBI Program through their retailer, compared to 47 percent under the SGIP. The most important determinant in choice of retailer, reported by 73 percent of PBI respondents and 65 percent of SGIP respondents, was its knowledge and experience with sales and installation. All PBI and SGIP respondents reported that their retailer/installer handled the paperwork and communications in almost all cases (that is, with the incentive program administrators, the utility company, and the permitting office). In general, 72 percent of the PBI respondents were satisfied with their retailer, compared to 83 percent of the SGIP respondents.

Figure 3 shows the average of all responses to a question asking participants to rank the degree of challenge posed by a number of factors. High system costs, exacerbated by the nature of the PBI payments over time, along with a lack of easily accessible information about the economic and financial benefits of the system and/or program were considered to be the largest challenges on average. Interconnection was considered the third largest challenge. Permitting, installation, system administrator to monitor PV performance, and financing were among the least challenging aspects.

**Figure 3. Challenges Under the Pilot PBI Program (N=17)**



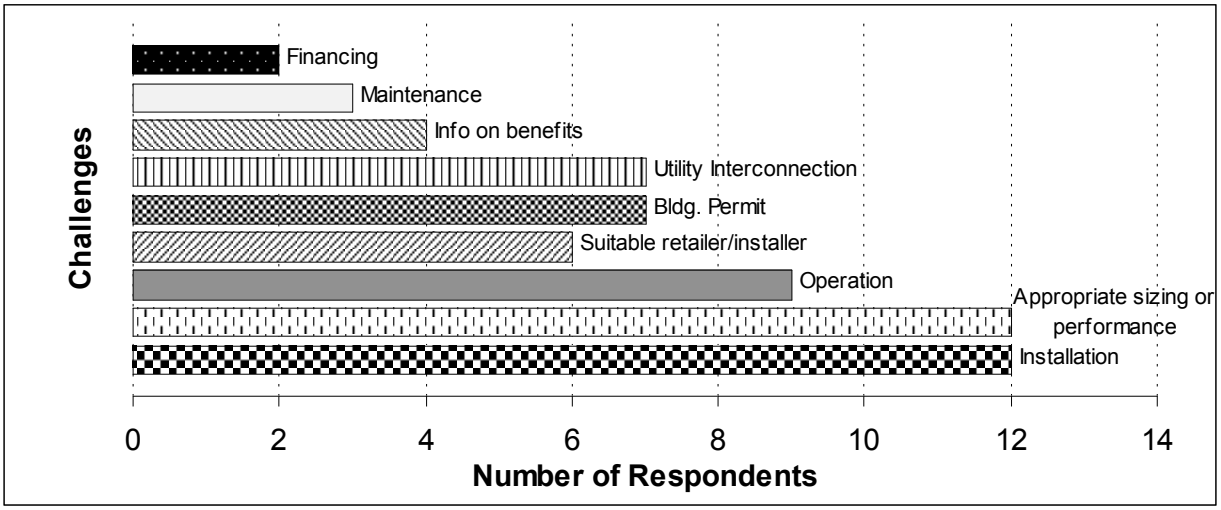

Other problems encountered with the PBI Program by survey respondents include:

- Energy Commission lost one of the reservation applications.
- Application and incentive payment process time are too long; it took a long time to approve funding.
- Little information offered about the PBI Program, including difficulty finding information about rebate level, program eligibilities, and its benefits to the customer.
- Warranty requirement for self-installation type should be optional.
- Available funding is not sufficient.

Some suggestions to improve the PBI Program consist of streamlining the application and payment process, increasing the incentive level, and not requiring a five-year warranty for self-installation.

Figure 4 shows the number of SGIP respondents identifying a given factor as a challenge. Though this question was of a different format than that included in the PBI survey, installation and appropriate sizing, along with performance or cost of the system, were the most-cited challenges. This stands in contrast to the PBI Program, where installation was ranked as one of the least-challenging aspects of project development. Operation was the second most challenging factor, followed by suitable retailer/installer, building permit, and utility interconnection.

**Figure 4. Challenges under the SGIP (N=43)**

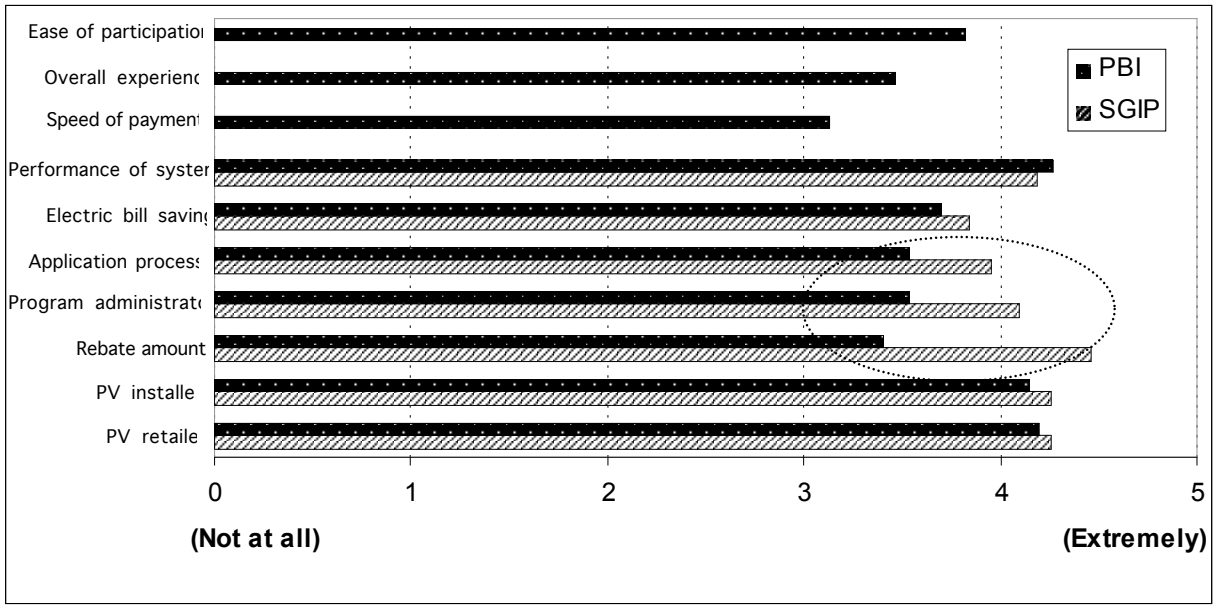



Other problems described by the SGIP respondents when asked an open-ended question include: delays in module delivery, utility tariff issues, engineering (roofing) issues, utility billing issues, lack of coordination between utility and installer, negative interaction with other incentives (for example, Renewable Energy Certificate sales), and net metering issues.

Finally, each survey included a request to "rank your satisfaction," with categories overlapping sufficiently to enable a composite graph (note that the "speed of payment," "overall experience," and "ease of participation" categories were included only in the PBI survey). As noted earlier and confirmed in Figure 5, respondents in each program appear to be quite satisfied with their retailers and/or installers. System performance also appears to provide a high level of satisfaction. As highlighted by the dashed oval in the figure below, the largest discrepancies between the two programs correspond to the incentive amount, the application process, and the program administrator, with the SGIP respondents more satisfied than the PBI respondents in all three cases.[12]

[12] The difference in incentive amount supports the notion, discussed in Footnote 15, that the CBI offered by the SGIP is generally considered to provide more value to a recipient than the PBI offered under the Pilot Program.

**Figure 5. Comparison of PBI Program and SGIP Satisfaction Levels**




# Additional PBI Program Survey Results

## *Customer Background*

Table 7 shows that of the 17 survey PBI respondents, 65 percent are from the PG&E service territory, 23 percent are from SCE, and 12 percent are from SDG&E. This sample distribution is representative of that of the total 41 PBI applicants in the database, with 27 (66 percent) customers from PG&E, and 9 (22 percent) and 5 (12 percent) customers from the service territories of SCE and SDG&E, respectively. Among the PBI respondents, 59 percent are commercial customers, 23 percent are non-profit, and 18 percent are residential.

**Table 7. PBI Respondents by Customer Class and Utility Provider (N=17)**

| End-use Customers | Utility Provider | | | Total |
|---|---|---|---|---|
| | PG&E | SDG&E | SCE | |
| Residential | 1 | 0 | 2* | 3 |
| Commercial | 7 | 1 | 2 | 10 |
| Non-profit | 3 | 1 | 0 | 4 |
| **Total** | 11 | 2 | 4 | 17 |

*One of the respondents in SCE's service territory indicated that it was both a residential and commercial customer; we have included this respondent in the residential category.

## *System and Performance Characteristics*

Table 8 shows that among 15 PBI respondents, six of the respondents' systems are (or will be) greater than 30 kW, which means that were they not participating in the PBI Program, they would be eligible for the SGIP (and ineligible for the ERP, outside of the PBI Program). Two did not respond to this question.

**Table 8. PV System Capacity of PBI Respondents (N=15)**

| Respondents by Utility Provider | System Size in kW (generating capacity) |
|---|---|
| *PG&E* | 79 |
| | 5 |
| | 20 |
| | 18 |
| | 6 |
| | 20 |
| | 21 |
| | 60 |
| | 200 |
| | |
| *SDG&E* | 75 |
| | 69 |
| | |
| *SCE* | 10 |
| | 8 |
| | 29 |
| | 119 |
| | |
| **Total** | 739 |

Ninety-one percent of PBI respondents report systems facing due south, while one system is mounted flat. Forty-two percent of PBI respondents have PV systems tilted between 1° and 15°, another 42 percent have PV systems tilted 15°-30°, 8 percent are tilted more than 30°, and another 8 percent reported no tilt. Seventy-one percent of PBI respondents said that their systems have no shading, while 29 percent reported to have some shading, which varies from 5 percent to <17 percent, averaging a 9 percent expected loss in output.

Seven PBI systems are already operational, while three expected to have their systems installed during the second half of 2006. The remaining seven systems were not installed at the time of the survey. Two PBI respondents reported a unique feature of their PV systems: a wireless connection to the Internet for tracking data and a reverse tilt on a north-facing roof.

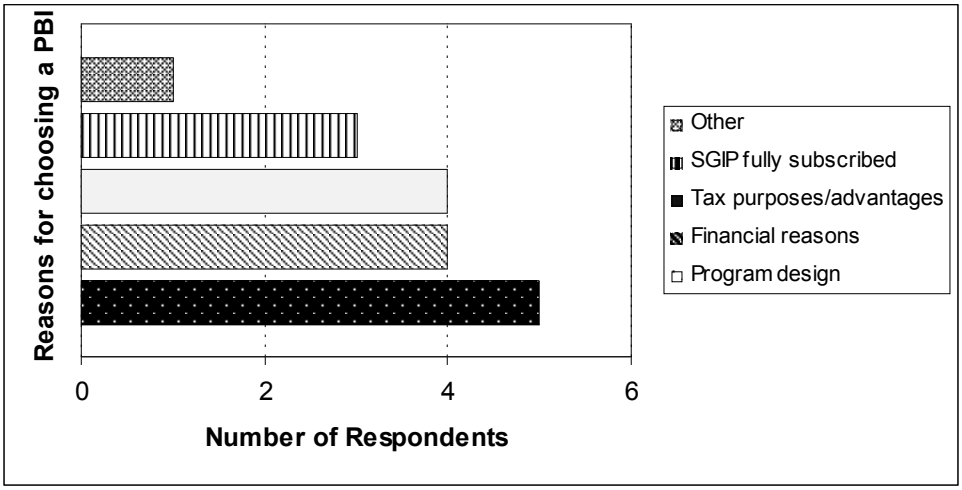
## *Program Choice and Financial Assumptions*

Sixty-one percent of PBI respondents had the opportunity to choose a CBI program, while 31 percent claim to have been limited to the PBI Program, and 8 percent did not know the option.[13] When asked if a CBI program would have changed their system configuration, and if so, how, 25 percent of PBI respondents reporting a choice of programs noted that they would have chosen a larger PV system, 13 percent of respondents would have used a tracking system, 12 percent would have changed the PV system type, while 50 percent of respondents would have changed their system maintenance practices, presumably toward conducting less maintenance, though that information was not specified.

[13] It is not clear why any respondents would not have had access to a CBI rebate program. Presumably all of the systems in the sample that are less than 30 kW could have applied to the ERP, while all systems 30 kW or greater could have applied to the SGIP. Perhaps this response reflects the fact that the SGIP program has, at times, been fully subscribed. The fact that three respondents cited the presence of a waiting list in the SGIP as a reason for choosing the Pilot PBI Program also supports this notion.

Among the 12 PBI respondents, the top choice (multiple answers were accepted) of why respondents chose a PBI over a CBI was that program design encourages better system performance (5 respondents). Financial reasons[14] and tax purposes/advantages[15] are the second reason why applicants decided to go with the PBI program. Three respondents chose the PBI program because the SGIP was fully subscribed at the time, and one reported that the PBI program had no penalty for self-installation.[16] Five did not respond to this question.

**Figure 6. Reasons PBI Respondents Chose a PBI over a CBI Program (N=12)**




As shown in Figure 7, environmental (23) and retailer/installer recommendation (19) were the top reasons why the 43 SGIP respondents chose to participate in the SGIP specifically. Three respondents said they had no other alternative,[17] and 14 selected the "Other" category. [18]

[14] This is an interesting response given that analysis involving a financial pro forma model suggests that a significantly higher PBI level than currently offered (or a higher-than-average level of performance) would be required to provide the same value (in terms of net present value of after-tax cash flow) as the CBI's recently offered by either the SGIP or the ERP.

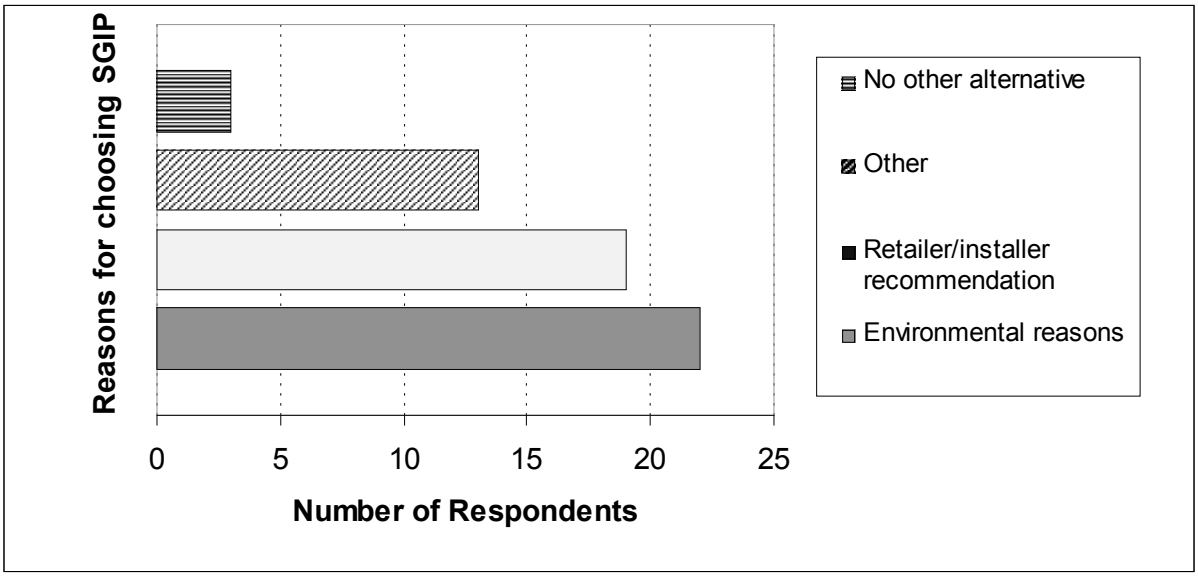
[15] Note that, despite conventional wisdom, it is not at all clear that a PBI actually results in tax advantages (see slide 34 of http://eetd.lbl.gov/ea/ems/reports/cpuc-pv-tax.pdf).

[16] The ERP offers a 15 percent lower rebate for self-installed systems, whereas the Pilot PBI Program does not discriminate against owner-installed systems.

[17] Presumably some of these systems, in particular those installed since the inception of the PBI Program, could have enrolled in that program instead of the SGIP.

[18] The "Other" category includes: made the project economically feasible, reduce electric bills, availability of rebates, rare opportunity, and cost savings in the long run.

**Figure 7. Reasons SGIP Respondents Chose SGIP (N=43)**




Only 15 percent of SGIP respondents report having the ability to choose a different PV rebate program (that is, other than the SGIP). Of those, 50 percent identified CBI as the other program (they would have had to reduce system size to less than 30 kW to participate in the ERP), while 33 percent did not identify which other rebate program they could have chosen, and 17 percent identified PBI as the other rebate program. This suggests that the Energy Commission's Pilot PBI program, which was available to a greater number of SGIP participants than reflected in the survey responses, was not well publicized. Thirteen percent[19] of SGIP respondents said they would have changed the type and size of their system if they had gone with another rebate program. Twelve percent[20] of SGIP respondents have other systems participating under a CBI or PBI. Seventy-two percent of SGIP respondents report taking advantage of net metering, while 2 percent does not (claiming it is not offered), and the remaining 26 percent SGIP respondents stated they didn't know.

When asked an open-ended question on the advantages of the PBI program, PBI survey respondents noted similar advantages as noted before. Only two respondents cited a disadvantage – the cost of performance-monitoring equipment (and of ongoing monitoring) and that the incentive offered through the PBI program was too low to make the system financially viable.

Based on eight PBI respondents, the total eligible cost of the system varies from $7,014/kW to $10,499/kW, averaging $8,293/kW. Nine did not answer this question.

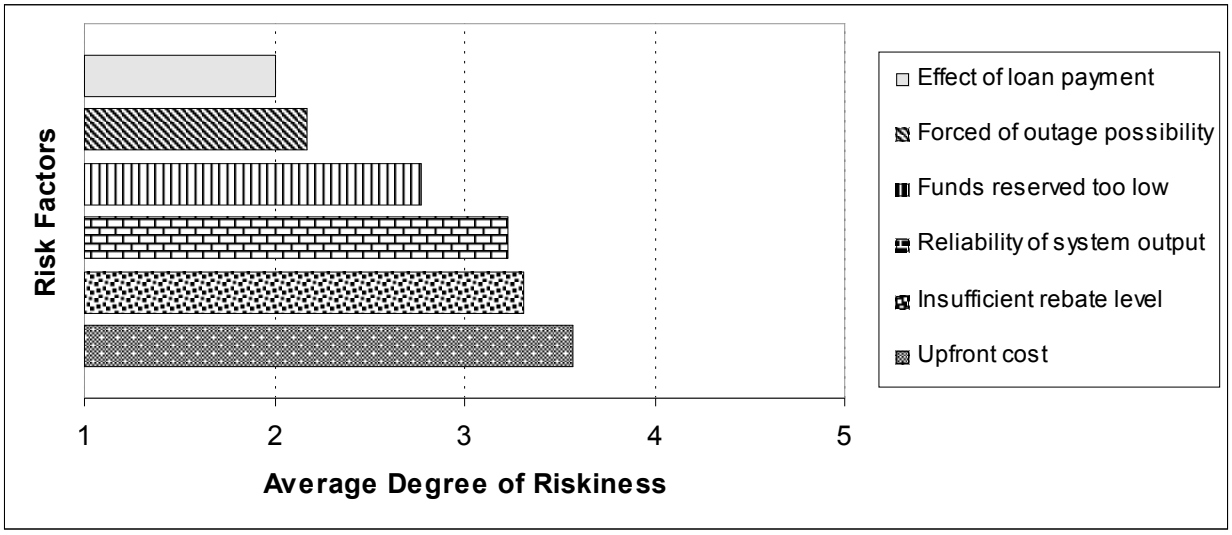
[19] One respondent would have changed to a smaller size; another respondent would change to twice the size of what he currently has; and the other two respondents did not describe how they would change the system.

[20] Three respondents have smaller systems (assuming residential applications), one is a fuel cell project, and another one is a 467 kW PV system with a 1 MW fuel cell.

## *Risks with PBI Program*

Among the PBI survey respondents, Figure 8 shows the average degree of risk assigned to six different factors. High upfront costs (again, exacerbated by the nature of a PBI relative to a CBI), along with an incentive amount that is potentially too small and dependent on system reliability, were considered to be the most risky factors, while the risk of economic damage, including loan default or forced outages, were considered the least risky.[21]

**Figure 8. Risks Surrounding the Pilot PBI Program (N=17)**




## *Customer Experience*

Forty percent of PBI respondents said that the 12-month reservation period was not long enough (with two citing delays caused by panel shortages as a reason to extend the reservation period), while 60 percent of PBI respondents indicated that they would prefer longer reservation periods.

Ten PBI respondents were not willing to consider a PBI payment period of longer than the current three years. Another four would be willing to increase the payment to seven years, while one would go even longer than seven years.[22] Two had no opinion. Thirteen PBI respondents were satisfied with quarterly incentive payments, yet two would prefer monthly payments, and one would prefer payments every six months. Four did not respond.

When asked to rate the importance of the upfront PBI reservation amount (this is only for the purpose of allocating a dollar amount) to their PV system installation planning, 53 percent of PBI respondents said "Very Important," while 29 percent said "Somewhat Important", and another 18 percent had no opinion. As with the SGIP survey, the state incentive is still the number one motivation why customers install a system with 86 percent of SGIP respondents answered "not at all likely" they would've installed the system without rebate while only 7

[21] The relatively low degree of risk assigned to loans may be a function of only three PBI respondents having financed their systems.

[22] It is possible that these five respondents misinterpreted the question by presuming that they would receive the same level of payment – that is, $0.50/kWh – over the longer payment period.

percent of SGIP respondents said they are "very likely" to install a system even without a rebate. The other 7 percent said "somewhat likely" and "don't know".

Three PBI respondents thought that the cost of reporting performance would hamper participation, while six did not, and eight did not respond.

# Chapter 4: Conclusions

The Energy Commission's PBI program was developed to test a new incentive design and to encourage installation of high performing solar PV systems. While the PBI program got off to a slow start, it is clear that in time PBI appealed to a range of people considering solar installations. By the time the program closed to new applicants at the end of 2006, 54 applicants had applied for the PBI program, and 37 projects were approved for reservations.

The survey developed for this report was helpful in understanding the background of some of the PBI program participants, as well as their experiences with both their retailer and the Energy Commission. However, the small sample size among both groups of respondents, and in particular the PBI respondents, coupled with a lack of complete standardization among the survey sent to each group, limits the authors' ability to draw any firm conclusions in this regard.

The majority of PBI participants are commercial applicants (59 percent) while others are non-profit (23 percent) and residential (18 percent) applicants. Considering that the cost of systems is the most challenging factor for PBI respondents, 79 percent of the PBI respondents used cash to pay for their systems.

Forty-two percent of PBI respondents chose to participate in the PBI program because incentive is based on production (program design). The survey was also able to obtain some of the PBI systems' characteristics, although there was a discrepancy on one system capacity (kW) between the database and what was indicated by a respondent. Eighty-three percent of respondents have south facing systems. Interestingly, a third of PBI respondents use tracking systems.

Some of the major challenges respondents faced include:

- Lack of understanding regarding PBI/ERP program eligibility and requirements.
- The difficulty in comparing incentive differences and their tax implication between the capacity-based and performance-based incentive designs.
- Uncertainty as to the actual system performance, including maintenance, weather, and other risks.

The Energy Commission staff spent more time and took a personalized approach with applicants in explaining the program requirement and how to meet them. In addition, applicants were assisted in filling out the reservation forms properly to avoid delays in approving their incentive amount and assure applicants/financiers that their incentives will be approved.

In general, the PBI and SGIP surveys each reveal participants who are very satisfied with their retailers and/or installers, as well as with the performance of their systems. Respondents also seem generally satisfied with the PBI and SGIP programs themselves.

High upfront costs remain a challenge to both programs, highlighting the need for incentive programs. However, it is not clear that the additional upfront costs facing a PBI recipient, relative to a CBI recipient, pose any *incremental* challenges, at least among the authors' sample of early PBI adopters. With the possible exception of the use of tracking systems, there does not appear to be much behavioral difference between the PBI and SGIP participants: knowledge of system output, the presence of maintenance contracts, financing methods, and plans to clean panels did not significantly differ by program.

A follow-up report is recommended, perhaps in 2008, to obtain the PBI participants' actual system design, installation, and performance data. To learn how these systems are performing, it is crucial to survey PBI participants with systems that are installed and operating. In addition, site verifications will be valuable as part of this follow-up evaluation to make sure those systems were installed properly and to see if there are discrepancies between information contained in the Energy Commission's records and what is found through a verification effort.

# Chapter 5: Glossary of Energy Terms

**AC**
Alternating current. Flow of electricity that constantly changes direction between positive and negative sides. Almost all power produced by electric utilities in the United States moves in current that shifts direction at a rate of 60 times per second.

**ANSI**
American National Standards Institute. The national organization that coordinates development and maintenance of consensus standards and sets rules for fairness in their development. ANSI also represents the United States of America in developing international standards.

**BVE**
Bear Valley Electric. An electric utility company serving the communities surrounding Big Bear Lake.

**California Energy Commission**
Also known as the Energy Commission. The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy and planning. The Energy Commission's role includes overseeing funding programs that support public interest energy research; advance energy science and technology through research, development, and demonstration; and provide market support to existing, new, and emerging renewable technologies.

**CF**
Capacity factor. The ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period.

**CBI**
Capacity-based incentive. An approach that pays an upfront rebate for the cost of a solar PV system based on a dollar per watt of a system's installed capacity.

**CPUC**
California Public Utilities Commission. A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court.

**Distributed generation**
Generation systems involving small amounts of generation located on a utility's distribution system for the purpose of meeting local (substation level) peak loads and/or displacing the need to build additional (or upgrade) local distribution lines.

**ERP**
Emerging Renewables Program. It was created to stimulate market demand for renewable energy systems that meet certain eligibility requirements by offering rebates/incentives to reduce the initial cost of the system to the customer.

**Insolation**
The total amount of solar radiation (direct, diffuse, and reflected) striking a surface exposed to the sky.

**kW**
Kilowatt . One thousand (1,000) watts. A unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon a typical home, with central air conditioning and other equipment in use, might have a demand of four kW each hour.

**kWh**
Kilowatt-hour. The most commonly-used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour.

**MW**
Megawatt. One thousand kilowatts (1,000 kW) or one million (1,000,000) watts. One megawatt is enough energy to power 1,000 average California homes.

**MWh**
Megawatt-hour. One thousand kilowatt-hours, or an amount of electricity that would supply the monthly power needs of 1,000 typical homes in the Western United States (This is a rounding up to 8,760 kWh/year per home based on an average of 8,549 kWh used per household per year [U.S. DOE EIA, 1997 annual per capita electricity consumption figures]).

**Net metering**
Net metering measures the difference between the electricity one buys from a utility and the electricity one generates using one's own solar (PV) or wind generating equipment. The customer's meter keeps track of this difference as the system generates electricity and takes electricity from the electricity transmission grid. When one generates more than one uses, the customer's electric meter spins backward.

**Outage (Electric utility)**
An interruption of electric service that is temporary (minutes or hours) and affects a relatively small area (buildings or city blocks).

**PBI**
Performance-based incentive. Incentive payments are based on actual energy produced over a period in kilowatt-hours (kWh) by an eligible solar PV system.

**PG&E**
Pacific Gas and Electric Company. An electric and natural gas utility company serving major potions of Central and Northern California.

**PTC**
Stands for PV USA Test Conditions which were developed at the PV USA test site in Davis, California. PTC rating includes the efficiency rating of both the PV modules and system inverter (represents 1,000 watts per square meter solar irradiance, 1.5 Air Mass, and 20° C ambient temperature at 10 meters above ground level and wind speed of 1 meter per second).

**PGC**
Public goods charge. A non-bypassable surcharge imposed on all retail sales to fund public goods research, development and demonstration, and energy efficiency activities, and possibly to support low income assistance programs.

**PV**
Photovoltaic. A semiconductor that converts light directly into electricity.

**Renewable energy**
Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro and wood.

**SB**
Senate Bill. A legislative bill sponsored or authored by a state Senator.

**SCE**
Southern California Edison. An electric utility company serving portions of Southern California region.

**SDG&E**
San Diego & Electric Company. An electric and natural gas utility company serving the San Diego, California region.

**Self-generation**
A generation facility dedicated to serving a particular retail customer, usually located on the customer's premises. The facility may either be owned directly by the retail customer or owned by a third party with a contractual arrangement to provide electricity to meet some or all of the customer's load.

**Service area**
The geographical territory served by a utility.

**SGIP**
Self-Generation Incentive Program. A statewide program (created by the California Public Utilities Commission) developed to provide incentives for the installation of certain renewable and clean generation technologies.

**Shading**
1) The protection from heat gains due to direct solar radiation; 2) Shading is provided by (a) permanently attached exterior devices, glazing materials, adherent materials applied to the glazing, or an adjacent building for nonresidential buildings, hotels, motels and high-rise apartments, and by (b) devices affixed to the structure for residential buildings.

**SoCalGas**
Southern California Gas Company. A natural gas utility company serving much of the Southern California region.

**Tariff**
A document, approved by the responsible regulatory agency, listing the terms and conditions, including a schedule of prices, under which utility services will be provided.

**Tax credits**
Discussed here as credits established by the federal and state government to assist the development of the alternative energy industry.

**Watt**
A unit of measure of electric power at a point in time, as capacity or demand. It is a unit of power equal to one joule of energy per second.

# Chapter 6: Appendix

## PBI Survey Sample

California Energy Commission
EMERGING RENEWABLES PROGRAM
Pilot Performance-Based Incentive Program
Evaluation Survey - June 2006

Customer Name: _____

Physical Address of PV System Installation: _____

Phone Number: (  ) _____ Best time to call during the day: _____

Or E-mail: _____

**A. Customer Background**

1. How would you describe your organizational type?
   __Residential __Commercial __Non-profit organization
   __Governmental __Other _____

2. How did you first learn about the Pilot Performance-Based Incentive (PBI) Program?
   __Energy Commission workshop __Energy Commission website
   __PV system retailer/installer __Other PBI participant
   __Other Internet site, please describe _____ __Other_____

**B. System Characteristics**

3. What is the rated capacity of your PV system? _____ kW (Energy Commission AC rating)

4. Does your PV system use tracking?
   __Yes If yes, what type? __Single axis __Dual axis
   __No

5. What is the orientation of your PV system?
   __W __SW __S __SE __E __Other _____

6. What is the tilt of your PV system? __None __1-15° __15-30° __>30°

7. What is the degree of shading of your PV system?
   __No shading
   __Some shading, provide estimated PV system output loss (i.e. 5%) _____

8. What is your retailer or installer's estimated annual PV system output? _____kWh/year

9. What is the minimum annual output needed to make your solar project economically viable?
   _____kWh/year

10. Do you plan to clean the panels?

__Yes If yes, how frequent? _____times/year
__No

11. On what (approximate) date did the PV system begin operation or do you expect operation to begin? _____ __Don't know

12. Other noteworthy features of your PV system? _____
_____

## C. Retailer/Installer Information

13. Why did you choose the specific retailer or installer that installed your PV system? Check one that best describes your reason.
__Knowledge and experience with sales and installation __Low-priced bidder
__Recommended by a friend or colleague __Other_____

14. Do you have a maintenance contract with your retailer/installer? If so, please describe.
__Yes,_____
__No

15. Did your retailer/installer handle the communications and paperwork for you with any or all of the following entities? (Check all that apply)
__Energy Commission __Utility company __Permitting office

16. Did your retailer/installer offer any minimum PV system performance guarantee?
__Yes __No

17. How satisfied were you with the retailer/installer?
__Very satisfied __Somewhat satisfied __Not at all satisfied __Don't know

## D. PBI Program Choice and Financial Assumptions

18. Did you have the opportunity to choose a capacity-based incentive program (that is, $/kW rather than $/kWh) instead of the PBI Program? __Yes __No (If no, skip Q.#19)

19. If you had gone with the capacity-based rebate program,
a. Would you have changed the PV system type?
__Yes, how? _____ __No
b. Would you have changed the PV system size?
__Yes, how? _____ __No
c. Would you have changed the PV system orientation or location?
__Yes, how? _____ __No
d. Would you have used a tracking system?
__Yes, how? _____ __No
e. Would you have performed maintenance as regularly?
__Yes, how? _____ __No

20. Why did you choose to participate in the PBI Program for PV systems instead of one of the capacity-based rebate programs? (Check all that apply)
__Program design encourages better system performance (that is, incentive is based on production)
__Financial reasons (that is, incentive is better including tax benefit)
__Tax purposes/advantages
__Self Generation Incentive Program is fully subscribed, requiring a long waiting list
__Other _____

21. Do you have other PV systems that participate under the capacity-based rebate program or PBI Program? __Yes (describe)_____ __No

22. Please explain any other advantages or disadvantages of PBI Program over a capacity-based program?

_____
_____

23. How did you purchase the PV system?

__Cash
__Financed □ Percent of total financed _____ %
Term _____ Years

If financed, what type did you use?

__Mortgage loan __Personal loan __Line of credit
__Other_____

Did the lender make any special requirements (such as, minimum down payment, system has to be installed within a certain time frame, or reporting requirement) on your loan?

__Yes (please describe)_____
__No

24. What is the total eligible cost of the PV system (including installation cost and permit fees) before any incentives? $_____

## E. Risks & Challenges

25. On a scale of 0 to 5, with 0 meaning "Not challenging", and 5 meaning the "Most challenging," have you experienced challenges regarding the *selection*, *design*, *installation*, and *operation* of your PV system? Please circle each factor.

| Not Challenging | | | | | Most Challenging | |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | The cost of the PV system |
| 0 | 1 | 2 | 3 | 4 | 5 | The performance of the PV system |
| 0 | 1 | 2 | 3 | 4 | 5 | Finding a suitable PV retailer (seller) |
| 0 | 1 | 2 | 3 | 4 | 5 | Finding a suitable PV installer (contractor) |
| 0 | 1 | 2 | 3 | 4 | 5 | Financing for purchase and installation |
| 0 | 1 | 2 | 3 | 4 | 5 | Information about economic and financial benefits |
| 0 | 1 | 2 | 3 | 4 | 5 | Building permits |
| 0 | 1 | 2 | 3 | 4 | 5 | Installation |
| 0 | 1 | 2 | 3 | 4 | 5 | Utility interconnection |
| 0 | 1 | 2 | 3 | 4 | 5 | Maintenance |
| 0 | 1 | 2 | 3 | 4 | 5 | Monitoring system administrator (3rd party web-based verifier) |

26. On a scale of 1 to 5, with 1 meaning the "Least risk," and 5 meaning the "Most risk," what do you think are the risks with the PBI Program? Please circle each factor.

| Least Risk | | | | Most Risk | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Reliability of system output |
| 1 | 2 | 3 | 4 | 5 | Upfront capital cost barrier |
| 1 | 2 | 3 | 4 | 5 | Amount of funds reserved for your PV system is too low |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Insufficient rebate level |
| 1 | 2 | 3 | 4 | 5 | Effect of loan payment if system is off-line for any length of time |
| 1 | 2 | 3 | 4 | 5 | Possibility of forced outage (i.e. utility black out, system output stopped due to weather-related problem) |

## F. PBI Program Experience

27. Does the 12-month reservation period allow enough time to plan and install the PV system?
__Yes __No

What reservation period would you prefer?
__18-month __24-month __More than 24 months

28. What maximum number of years would you be willing to accept payments for PBI?
__3 years __5 years __7 years __Over 7 years

29. Are you satisfied with quarterly payments?
__Yes __No

If not satisfied, what payment term is best?
__Monthly __Every other month __Every six months __Yearly

30. How important was the upfront PBI reservation amount to your PV system installation planning?
__Not important __Somewhat important __Very important

31. Do you feel that the cost associated with collecting and reporting system performance will prevent some people from participating in the PBI Program? Please explain.
__Yes __No

Explanation
_____
_____

32. What other problems did you encounter with the PBI Program?
_____
_____

33. Do you have any general or specific suggestions to improve the PBI Program?
_____
_____

34. Overall, on a scale of 1 to 5, with 1 meaning "Not at all satisfied," and 5 meaning "Extremely satisfied," how satisfied were you with:

| Not at all satisfied | | | | Extremely satisfied | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Your PV retailer (seller) |
| 1 | 2 | 3 | 4 | 5 | Your PV installer (contractor) |
| 1 | 2 | 3 | 4 | 5 | The PBI application process |
| 1 | 2 | 3 | 4 | 5 | Your reserved PBI amount |
| 1 | 2 | 3 | 4 | 5 | Your overall PBI participation experience |

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | The performance of your PV system |
| 1 | 2 | 3 | 4 | 5 | The time it takes to receive your PBI payment each quarter |
| 1 | 2 | 3 | 4 | 5 | Your electric bill savings |
| 1 | 2 | 3 | 4 | 5 | PBI Program easy to understand and participate in |
| 1 | 2 | 3 | 4 | 5 | Your overall experience with the Energy Commission |

# SGIP Survey Sample

California Public Utilities Commission
SELF-GENERATION INCENTIVE PROGRAM (SGIP)
Evaluation Survey - June 2006

**Customer Name (optional): _____**

**Phone Number(optional): (  ) _____**

**Best time to call during the day(optional): _____**

## A. Customer Background

1. System Location (Zip Code)_____

2. Program Administrator: ___PG&E ___SCE ___SDG&E ___SoCalGas

3. How did you first learn about the SGIP?
   ___CPUC workshop
   ___CPUC website/literature
   ___Retailer/installer
   ___SGIP Administrators
   ___Other SGIP participants
   ___Other, please describe_____

## B. System Characteristics

4. What is the size of your system?
   _____ kW (CEC AC rating)

5. Does your system use tracking?
   ___Yes ___No
   If tracking, what type: ___Single axis ___Dual axis

6. What is the estimated annual system output?
   _____kWh/year

7. What is the minimum annual output needed to make your solar project viable?
   _____kWh/year

8. Has your system been cleaned (in the dry season)?
   ___Yes, and I plan on cleaning the panels every _____ months.
   ___No, but I plan on cleaning the panels every _____ months.
   ___No, I don't plan to clean the panels.

9. On what (approximate) date did the system begin operation?
_____ ___Don't know
10. Other noteworthy features of your system?
_____
_____

## C. Retailer/Installer Information

11. Why did you choose the retailer or contractor that installed your system? Check one that best describes your reason.
___Knowledge and expertise on the system
___Has done a lot of sales and installation
___Recommended
___Other (Please specify) _____

12. Do you believe they offer higher quality systems and/or installations or superior qualifications over other retailers?
___Yes ___No
Please explain.
_____
_____

13. Do you have a maintenance contract with your retailer/installer? If so, please describe.
___Yes, _____ ___No

14. How difficult was it for you to get your system up and running?
___Not at all difficult
___Somewhat difficult
___Very difficult
___Don't know

15. Did your retailer/installer handle the communications and paperwork for you with any or all of the following entities? (Check all that apply)
___Utility company
___CPUC administrator
___Permitting office
___SGIP Program Administrator

## D. SGIP Choice, Economics and Financial Assumptions

16. Who in your business decided to install your system?
___Me ___Partner ___Other _____

17. How likely is it that you would have installed the system had you received no rebate?
___Not at all likely
___Somewhat likely
___Very likely
___Don't know
18. What did you expect the payback of your renewable energy investment to be? (Payback is the number of years it takes before your electric bill savings equal the cost of the system to you)
___Less than 2 years ___2 to 5 years
___5 to 10 years ___10 to 15 years
___15 to 25 years ___Don't know

___Payback was not a factor in my purchase

19. What were the primary reasons for wanting to purchase and use renewable energy technology? (Check all that apply and circle the most important.)

___Reduce electricity bills
___Improve overall reliability of my electricity supply
___Concern for the environment
___Become independent of my electric utility
___Promote/test new technology
___Other (please describe) _____

20. Why did you choose to participate in the SGIP?

___Environmental reasons
___Retailer/installer recommendation
___No other alternative
___Other _____

21. Did you have the opportunity to choose other capacity-based or performance- based program rebates? ___Yes ___No

If Yes, was the other rebate program:
___Capacity-Based ___Performance Based

22. If you had gone with another rebate program, would you have changed the type and size of your system?

___Yes ___No

If yes, how? _____

23. Do you have other systems that participate under the capacity-based rebate program or Performance-Based Incentive Program?

___Yes (describe)_____ ___No

24. Are you taking advantage of the "net metering" rate benefits offered by your utility?

___Yes
___No, why not? _____
___Don't know

25. How did you purchase the system?

___Cash ___Financed □ % of total financed? _____ %

# Years? _____ Years

Interest Rate? _____ %

If financed, what type of financing did you use?

___Mortgage loan ___Personal loan ___Other_____

Did the lender require additional requirements?

___Yes _____ ___No

26. What kind of tax credits did you receive for this system? Check all that apply.

___Federal Tax Credit
___State Tax Credit
___Not eligible for tax credits
___Did not receive tax credits

## E. Risks & Challenges

27. Regarding the *selection*, *design*, *installation*, and *operation* of your system, have you experienced challenges finding or dealing with any of the following:

| | | |
|---|---|---|
| The appropriate sizing, performance or cost of the system | __Yes | __No |
| A suitable retailer/installer | __Yes | __No |
| Financing for purchase/installation | __Yes | __No |
| Information about economic and financial benefits | __Yes | __No |
| Building permits | __Yes | __No |
| Installation | __Yes | __No |
| Operation (energy production or power output) | __Yes | __No |
| Maintenance | __Yes | __No |
| Utility interconnection | __Yes | __No |

28. Did you encounter any other problems?

_____

_____

29. Overall, on a scale of 1 to 5, with 1 meaning "Not at all satisfied" and 5 meaning "Extremely satisfied," how satisfied were you with:

| Not at all satisfied | | | | Extremely satisfied | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Your retailer/installer |
| 1 | 2 | 3 | 4 | 5 | Your rebate amount |
| 1 | 2 | 3 | 4 | 5 | Your SGIP Program Administrator |
| 1 | 2 | 3 | 4 | 5 | Your application process |
| 1 | 2 | 3 | 4 | 5 | Your electric bill savings |
| 1 | 2 | 3 | 4 | 5 | The performance of your solar system |